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③. $A = \begin{bmatrix} 0 & -1 \\ 2 & 3 \end{bmatrix}$

$|A - I\lambda| = 0$

$$\left| \begin{bmatrix} 0 & -1 \\ 2 & 3 \end{bmatrix} - \begin{bmatrix} \lambda & 0 \\ 0 & \lambda \end{bmatrix} \right| = 0$$

$$\begin{vmatrix} -\lambda & -1 \\ 2 & (3-\lambda) \end{vmatrix} = 0$$

$-\lambda(3-\lambda) + 2 = 0$

$-3\lambda + \lambda^2 + 2 = 0$

$\lambda^2 - 3\lambda + 2 = 0$

$\lambda^2 - 2\lambda - \lambda + 2 = 0$

$\lambda(\lambda-2) - 1(\lambda-2) = 0$

$\boxed{\lambda = 1, 2}$

for $\lambda = 1$

$(A - I\lambda)\vec{V} = 0$

$$\begin{bmatrix} -1 & -1 \\ 2 & 2 \end{bmatrix} \begin{bmatrix} \vec{V_1} \\ V_2 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$

$-V_1 - V_2 = 0$

$2V_1 + V_2 =$

$V_1 = -V_2$

for $\boxed{V_2 = 1 ; V_1 = -1}$

$$\vec{V} = \begin{bmatrix} -1 \\ 1 \end{bmatrix}$$

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for $\lambda = 2$

$$\begin{bmatrix} -2 & -1 \\ 2 & 1 \end{bmatrix} \begin{bmatrix} v_1 \\ v_2 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$

$-2v_1 - v_2 = 0$

$-2v_1 = v_2$

$\cancel{\text{if } v_2 = -1}$

if $v_1 = 1$

$v_2 = -2$

$$\therefore \vec{V} = \begin{bmatrix} 1 \\ -2 \end{bmatrix}$$

for $\lambda = 1$

eigen vector $= \begin{bmatrix} -1 \\ 1 \end{bmatrix}$

for $\lambda = 2$

eigen vector $= \begin{bmatrix} 1 \\ -2 \end{bmatrix}$

yes, the solution is same as of linalg module in numpy to find eigen value & vector.